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(54) **A gearbox lubricant composition
based on a polyoxyalkylene fluid**

(57) A lubricant composition comprising as base lubricating oil a polyoxyalkylene fluid and as additive minor proportions of

- 1) a thiodiarylamine;
 - 2) an alkylated diarylamine, and
 - 3) an N-acyl sarcosine,
- is used in a gearbox.

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SPECIFICATION

A lubricant composition based on a polyoxyalkylene fluid and a gearbox containing this composition

5 This invention relates to a lubricant composition comprising as base oil a polyoxyalkylene fluid and to a gearbox containing this composition. 5

A lubricant for a gearbox must be capable of functioning satisfactorily under the most severe conditions to be encountered during operation of the gearbox. It should therefore offer good ferrous corrosion protection in the presence of salt water, sludge-free operation at temperatures in excess of 120°C, low foaming tendency 10 and low friction losses. 10

It has been found that these requirements are fulfilled by using a special combination of additives in the polyoxyalkylene base fluid.

According to the invention a lubricant composition meeting the above requirements comprises as base lubricating oil a polyoxyalkylene fluid and as additives minor proportions of

- 15 1) a thiodiarylamine; 15
2) an alkylated diarylamine, and
3) an N-acyl sarcosine.

The use of a polyoxyalkylene fluid as base oil in gearbox lubricant compositions is already known from British patent specification 1,294,856. It is stated that these fluids have a superior oxidation stability at high 20 temperatures compared with mineral lubricating oils. Furthermore, these compositions may contain additives (1) as anti-oxidants and additives (3) as anti-rust and friction-reducing additives. 20

It has now surprisingly been found that replacing part of additive (1) by additive (2) in such compositions results into superior anti-oxidant properties and less sludge or even no sludge at the high temperatures encountered during continuous operation of gearboxes.

25 Suitable polyoxyalkylene fluids are copolymers or condensation products of an alkylene oxide, in particular ethylene oxide and propylene oxide, such as described in British patent specification 1,294,856, preferably having viscosities of 140-230 mm²/s at 38°C. 25

In the present compositions the base fluid preferably is a polypropylene glycol, preferably having a molecular weight of about 2000 and a viscosity of about 160 mm²/s at 38°C, since in this fluid additive (3) 30 gives a better ferrous metal corrosion protection than in the copolymers of ethylene oxide and propylene oxide, which are to be preferred according to the above patent specification. 30

Suitable additives (1) are also described in the above-mentioned patent specification, the preferred ones being phenothiazine and substituted phenothiazines, such as alkylated phenothiazines.

Suitable additives (2) are described in U.S. patent specification 2,687,377, such as dialkylated 35 diarylamines, in particular dialkylated diphenylamines having alkyl groups of 6-30, preferably 8, carbon atoms each. 35

Additives (3) function as anti-corrosion additives and as friction reducers.

Suitable additives (3) are described in British patent specification 1,294,856. The preferred additive (3) is N-oleyl sarcosine, which is N-oleylmethylamino acetic acid.

40 Suitable proportions of additives (1), (2) and (3), each, are 0.01-15%w, e.g. 0.1-10%w, based on the lubricant composition. 40

Other additives may be used as well, such as thickeners, e.g. to render the present compositions semi-fluid, extreme pressure additives, other anti-oxidants, friction reducers and anti-corrosion additives, metal deactivators, such as triazoles, e.g. benztriazole, anti-foam additives, such as silicone fluids, metal-free 45 dispersants, and metal salts, such as neutral and basic Ca and/or Mg salicylates. 45

The present base oils may be mixed with minor proportions of other lubricating oils, such as mineral or synthetic hydrocarbon oils, hydrotreated oils, and ester oils.

The present compositions are particularly suitable for use in worm gearboxes, but can also be used in other gearboxes, such as bevel and hypoid gearboxes, and as crankcase oils, as compressor oils, e.g. of the piston-type, e.g. for compressing air or natural gas, as turbine oils, as refrigerator oils, as metal-working oils 50 and as hydraulic oils. 50

The following compositions were tested (proportions in %w):

Composition A (according to the invention)

55		55
Additive (1):	phenothiazine	0.5
Additive (2):	dioctyldiphenylamine	3.0
60 Additive (3):	N-oleyl sarcosine	0.4 60
Polypropylene glycol (molecular weight 2000, viscosity 22 mm ² /s at 100°C and 146 mm ² /s at 38°C)		96.1

Additionally containing 0.005%w benztriazole and 0.0002%w silicone fluid.

Composition B (commercial gearbox lubricant, not according to the invention)

5	Additive (1) of composition A:	2	5
	Additive (3) of composition A:	0.3	
10	Condensation product of propylene oxide and ethylene oxide, molar ratio 85:15, viscosity 22 mm ² /s at 100°C and 140 mm ² /s at 38°C	97.7	10
15	These compositions were tested in an oxidation thermal stability test during 28 days at 135°C, using Cu and Fe catalysts and an air flow rate of 5 l/h.		15

TABLE

20	Composition	A	B	
	Viscosity mm ² /s, 40°C, before the test	161	140	20
	Viscosity mm ² /s, 40°C, after the test	160	153	
25	Acidity, mg KOH/g, before the test	0.7	0.5	25
	Acidity, mg KOH/g, after the test	0.55	0.45	
	Sludge, %w	0	0.03	
30	Cu weight change, mg	-3.8	0.2	30
	Fe weight change, mg	-0.1	0.2	

35 This Table shows that the present composition does not give rise to sludge and offers a good ferrous corrosion protection. 35

CLAIMS

- 40 1. A lubricant composition comprising as base lubricating oil a polyoxyalkylene fluid and as additives
minor proportions of
1) a thiodiarylamine;
2) an alkylated diarylamine, and
3) an N-acyl sarcosine. 40
- 45 2. A composition according to claim 1, wherein the polyoxyalkylene fluid is a polypropylene glycol. 45
3. A composition according to claim 1 or 2, wherein additive (1) is phenothiazine or a substituted
phenothiazine.
4. A composition according to any one of claims 1-3, wherein additive (2) is a dialkylated diphenylamine.
5. A composition according to any one of claims 1-4, wherein additive (3) is N-oleyl sarcosine.
- 50 6. A composition according to any one of claims 1-5, wherein additives (1), (2) and (3) each are present in
a proportion of 0.01-15%w, based on the composition. 50
7. A composition according to claim 1, substantially as hereinbefore described.
8. A gearbox containing a composition as claimed in any one of claims 1-7.